UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/915,895	07/26/2001	Paul W. Dent	4015-981	7299

24112 7590 06/03/2004

COATS & BENNETT, PLLC
P O BOX 5
RALEIGH, NC 27602

EXAMINER	
DANIEL JR, WILLIE J	

ART UNIT	PAPER NUMBER
2686	6

DATE MAILED: 06/03/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/915,895	DENT, PAUL W.	
	Examiner	Art Unit	
	Willie J. Daniel, Jr.	2686	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *10-20* is/are allowed.

6)☒ Claim(s) *1-9 and 21-29* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 July 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *2, 3, and 5*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement (IDS) submitted on

    a. 18 December 2001

    b. 25 September 2002

    c. 08 December 2003

are in compliance with the provisions of 37 CFR 1.97 and is being considered by the examiner.

Drawings

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description:

    a. Fig. 1 "ref. 24" is not mentioned in specification.

A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

3. The disclosure is objected to because of the following informalities:

    a. FIR and IIR are used in the specification on page 12, line 22 without providing an explanation for the acronym.

Appropriate correction is required.

Claim Objections

4. Claim 1 is objected to because of the following informalities:

   a. Applicant states "two or more transmitters and a fewer number of receivers" which does not show a connection between the receivers and transmitters. Examiner suggests using "more transmitters than receivers".

Appropriate correction is required.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-5, 7-9, 21, and **23-29** are rejected under 35 U.S.C. 102(b) as being anticipated by Harrison (US 6,067,324).

Regarding **Claim 1**, Harrison disclose a method of estimating propagation channels between two or more antenna elements (1) which reads on the claimed "transmitters" and a fewer number of subscriber unit (200) which reads on the claimed "receivers (200)" (see Figs. 1, 2, and 5), the method comprising:

transmitting channel impulse response which reads on the claimed "information signals" for said receivers (200) jointly from said two or more transmitters (1), said information signals pre-filtered based on propagation channel estimates (see col. 2, line 65 - col. 3, line 27; Figs. 1-3 and 5), where the antenna elements transmit channel information to the receivers (200) to provide control data information for estimating the channel propagation;

transmitting at least one "synthesized pilot" which reads on the claimed "dummy pilot" signal jointly from said transmitters, said at least one dummy pilot signal pre-filtered based on said propagation channel estimates (see col. 4, lines 14-29; Fig. 1), where the synthesized pilot is used as reference between the transmitter and receiver to monitor traffic channels for errors; and

receiving feedback which reads on the claimed "loop back signals" from said receivers (200) having dummy pilot signal interference that is dependent on the accuracy of said propagation channel estimates (see col. 3, lines 11-27), where the feedback information is used to detect errors in the signal; and

revising said propagation channel estimates based on said loop back signals (see col. 4, lines 60-67), where the channel is adaptively adjusted based on the signal weight of the traffic channel pilot.

Regarding **Claim 2**, Harrison discloses wherein revising said propagation channel estimates based on said loop back signals comprises:

correlating said loop back signals with said information signals to determine an amount of dummy pilot signal interference (see col. 3, lines 1-27; col. 5, lines 24-31; col. 6, lines 22-29,49-64; Figs. 1 and 4), where the synthesized pilot provides a reference of the composite traffic channel to minimize the interference; and

adjusting said propagation channel estimates to reduce said dummy pilot signal interference in said loop back signals (see col. 3, lines 1-27; col. 4, lines 18-37,61-67; Fig. 1), where the estimates are used to filter out the noise by using the synthesized pilot as a reference.

Regarding **Claim 3**, Harrison discloses wherein said propagation channel estimates comprise propagation channel estimate vectors relating each said receiver (200) to said transmitters (1), and further comprising determining a supplemental channel estimate vector for each one of said at least one dummy pilot signal, such that said supplemental channel estimate vectors are orthogonal to said channel estimate vectors (see col. 2, line 55 - col. 3,

line 27; col. 3, line 43 - col. 4, line 17; col. 5, lines 31-40; col. 6, lines 17-21), where the synthesized pilot has a correlated vector in which eigenvectors are orthogonal.

Regarding **Claim 4**, Harrison discloses wherein pre-filtering said at least one dummy pilot signal based on said propagation channel estimates comprises pre-filtering said at least one dummy pilot signal using said supplemental channel estimate vector (see col. 2, line 55 - col. 3, line 27; col. 3, line 43 - col. 4, line 17; col. 4, lines 63-67; col. 5, lines 31-40; col. 6, lines 17-21), where the synthesized pilot and the associated vector is used for recalculation of the estimated measurements for pre-filtering the propagation of the channel.

Regarding **Claim 5**, Harrison discloses wherein transmitting information signals for said receivers (200) jointly from said transmitters (1) comprises transmitting an information signal for one receiver (200) jointly from two transmitters (1) (see col. 2, line 45-48; Fig. 5), where the multiple antenna element transmits to a receiver which would be obvious.

Regarding **Claim 7**, Harrison discloses wherein transmitting information signals for said receivers (200) jointly from said transmitters (1) comprises transmitting a combination of information signals for a first plurality of receivers (200) from each one in a larger plurality of transmitters (see col. 2, line 45-48; col. 2, line 65 - col. 3, line 3,), where the antenna array has multiple antenna elements transmitting to a subscriber unit in which it would be obvious to transmit signals from multiple transmitters to a smaller number of receivers as done with multiple input multiple output (MIMO).

Regarding **Claim 8**, Harrison discloses wherein said transmitters are radio base transceiver (300) which reads on the claimed "stations", and wherein comprises pre-filtering said information signals to form a combined transmit signal for each one of said transmitters,

said combined transmit signals representing differently weighted combinations of said information signals based on said pre-filtering using said propagation channel estimates (see col. 3, line 1 - col. 4, line 29), where the channel impulse response are estimated and combined for modifying traffic signals of the channel in which the antenna elements are coupled to the base transceiver.

Regarding **Claim 9**, Harrison discloses further comprising pre-filtering said at least one dummy pilot signal, such that said combined transmit signals further comprise a weighted version of said at least one dummy pilot signal (see col. 3, lines 1-10; col. 3, line 42 - col. 4, line 29; col. 4, lines 61-67), where the synthesized pilot is used during the recalculation.

Regarding **Claim 21**, Harrison discloses a wireless communication network comprising:

a transmit processor operative to form a number of transmit signals as weighted combinations of at least one individual information signals and at least one dummy signal by pre-filtering the information signals and the at least one dummy signal using propagation channel estimates (see col. 2, lines 45-48; col. 2, line 65 - col. 3, line 17; Figs. 1 and 5), where the transmit processor would be inherent;

a number of transmitters (1) operative to transmit said transmit signals (see col. 2, lines 45-48,65-67; Fig. 5);

a loop back signal processor operative to determine interference at one or more wireless receivers (200) receiving said transmit signals caused by transmission of said at least one dummy signal based on receiving loop back signals from the one or more wireless receivers

(200) (see col. 3, lines 1-27; col. 5, lines 24-31; col. 6, lines 49-64), where the subscriber unit provides feedback in which the loop back signal processor would be inherent;

wherein said transmit processor adjusts said propagation channel estimates to reduce interference caused by transmitting said at least one dummy signal based on said determined interference (see col. 3, line 1-27; col. 4, lines 54-67; col. 5, lines 24-31; col. 6, lines 49-64), where the system adjust to reduce the interference in which the transmit processor would be inherent.

Regarding **Claim 23**, Harrison discloses wherein said transmitters (1) comprise a number of radio base stations (300) (see Fig. 5), where the antenna array is coupled to the base transceiver in which a number of radio base stations would be obvious.

Regarding **Claim 24**, Harrison discloses wherein said transmit processor is further operative to form a channel estimate matrix comprising the propagation channel estimates (see col. 3, line 43 - col. 4, line 2; col. 4, lines 54-67), where the transmit processor would be inherent.

Regarding **Claim 25**, Harrison discloses wherein said transmit processor is further operative to form said channel estimate matrix as a channel estimate vector for each of the at least one information signals, and a channel estimate vector for each one of the at least dummy signal, wherein the channel estimate vectors for the information signals characterize actual propagation channels from each transmitter (1) to a wireless receiver (200) for which the information signal is intended (see col. 3, lines 1-10; col. 3, line 42 - col. 4, line 17; col. 4, lines 63-67; col. 5, lines 31-40; col. 6, lines 10-36), where the estimated channel impulse

responses provide weighted information to create a synthesized pilot and the associated vector that provides feedback information of the composite channel.

Regarding **Claim 26**, Harrison discloses wherein the transmit processor is further operative to form the channel estimate vectors for the at least one dummy signal orthogonal to the channel estimate vectors for the one or more information signals, such that if the channel estimate vectors for the information signals substantially match the actual propagation channels, the at least one dummy signal will cancel at each wireless receiver receiving the transmit signals (see col. 2, line 55 - col. 3, line 27; col. 3, line 42 - col. 4, line 17; col. 4, lines 63-67; col. 5, lines 31-40; col. 6, lines 10-36), where the synthesized pilot cancels the noise at the associated receiver in which eigenvectors are orthogonal.

Regarding **Claim 27**, Harrison discloses wherein said transmit processor comprises one or more signal processors operative to perform said pre-filtering (see col. 3, lines 1-27; col. 4, lines 54-67; col. 6, lines 44-57; Fig. 5), where the system performs an estimation of channel impulse responses for pre-filtering in which the processors would be inherent.

Regarding **Claim 28**, Harrison discloses wherein said loop back processor comprises one or more signal processor operative to determine said interference at said receivers (200) by correlating said loop back signals with said dummy signals and said information signals (see col. 3, lines 1-27; col. 5, lines 24-31; col. 6, lines 22-29,49-64; Figs. 1 and 4), where the subscriber unit provides feedback in which the loop back signal processor would be inherent.

Regarding **Claim 29**, Harrison discloses a wireless network processing system in a wireless communication network wherein a number of transmitters jointly transmit to a lesser number of receivers, the wireless network processing system comprising:

a loop back signal processor to determine interference in a loop back signal from a wireless receiver caused by a dummy pilot signal being transmitted by said transmitters (1) (see col. 3, lines 1-27; col. 5, lines 24-31; col. 6, lines 49-64), where the subscriber unit provides feedback in which the loop back signal processor would be inherent; and

a transmit processor to adjust a transmit pre-filter being applied by said transmit processor to an information signal for the wireless receiver, and being applied to said dummy pilot signal, based on said determined interference (see col. 3, lines 1-27; col. 4, lines 18-37,61-67; Fig. 1), where the estimates are used to filter out the noise by using the synthesized pilot as a reference in which the transmit processor is inherent;

wherein said loop back signal processor and said transmit processor cooperate to make propagation channel estimates on which said transmit pre-filter is based substantially match actual propagation channel characteristics between said transmitters and the wireless receiver by adjusting said propagation channel estimates to reduce said determined interference (see col. 3, lines 1-27; col. 4, lines 14-29; col. 5, lines 24-31; col. 6, lines 22-29,49-64; Figs. 1 and 4), where the synthesized pilot is a reference of the composite channel to monitor the interference in which the loop back signal processor and transmit processor are inherent.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 6 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harrison (US 6,067,324) in view of Raleigh et al. (hereinafter Raleigh) (US 6,144,711).

Regarding **Claim 6**, Harrison discloses wherein transmitting an information signal for one receiver jointly from two transmitters (1) comprises transmitting the information signal through a different propagation channel to said receiver (200) (see col. 2, lines 45-48; col. 3, lines 1-3; col. 6, line 39-43; Fig. 5), where the impulse responses are transmitted over different paths to the subscriber unit. Harrison fails to disclose having two transmitters transmitting two transmit polarizations. However, the examiner maintains that having two transmitters transmitting two transmit polarizations was well known in the art, as taught by Raleigh.

In the same field of endeavor, Raleigh teaches having two transmitters (152) transmitting two transmit polarizations (see col. 7, lines 36-49; Fig. 5), where the transmitter transmit both A.and B polarization.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Harrison and Raleigh to have two transmitters transmitting two transmit polarizations, in order to create more than one subchannel or multipath, as taught by Raleigh.

Regarding **Claim 22**, Harrison discloses wherein said transmitters ()comprise a number of antenna elements (1) on a transmitting array which reads on the claimed "antenna" (see col. 2, lines 45-48; col. 3, lines 1-3; col. 6, line 39-43; Fig. 5). Harrison fails to disclose having antenna elements having a different polarization than another antenna element. However, the examiner maintains that having antenna elements having a different polarization than another antenna element was well known in the art, as taught by Raleigh.

Raleigh further discloses antenna elements (55) having a different polarization than another antenna element (see col. 7, lines 36-49; Fig. 5), where the antenna elements have A and B polarization.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Harrison and Raleigh to have two transmitters transmitting two transmit polarizations, in order to create more than one subchannel or multipath, as taught by Raleigh.

Allowable Subject Matter

7. **Claims 10-20** are allowed.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding **Claim 10**, the applied references, Harrison (US 6,067,324) and Raleigh et al. (US 6,144,711), fail to disclose or render the obvious, a method of facilitating estimation of propagation channels between a first number of transmitters and a lesser number of receivers, the method comprising:

transmitting information signals for said receivers jointly from said transmitters based on propagation channel estimates, such that interference between information signals is reduced at each said receiver; and

transmitting a number of dummy pilot signals equal to a difference between the number of transmitters and receivers, such that said dummy pilot signals cause substantially no interference in reception of said information signals by said receivers when said propagation channel estimates substantially match said propagation channels.

Regarding **Claim 20**, the applied references, Harrison (US 6,067,324) and Raleigh et al. (US 6,144,711), fail to disclose or render the obvious, a method of estimating propagation channels between a number transmitters and a lesser number of receivers, the method comprising:

initializing a set of propagation channel estimates for said propagation channels;

generating a number of dummy pilot signals equal in number to a difference between said number of transmitters and receivers;

determining supplemental propagation channel coefficients for each said dummy pilot signal based on said propagation channel estimates intended to cause said dummy pilot signals to substantially cancel at each said receiver, thus causing no interference at said receivers;

pre-filtering said dummy pilot signals and an information signal for each said receiver using said propagation channel estimates and said supplemental propagation channel estimates;

transmitting said information signals and said dummy pilot signals jointly from said transmitters to said receivers after said pre-filtering; and

adjusting said propagation channel estimates based on observed dummy pilot signal interference at said receivers.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

   a. Papasakellariou (US 6,700,919) discloses "Channel Estimation For Communication System Using Weighted Estimates Based On Pilot Data and Information Data".

   b. Buehrer et al. (US 6,614,857) discloses "Iterative Channel Estimation And Compensation Based Thereon".

   c. Dent (US 6,507,602) discloses "Smoothing Receiver Channel Estimates Using Spectral Estimation".

   d. Farsakh (US 6,317,612) discloses "Method For Estimating Spatial Parameters Of Transmission Channels By Estimating A Spatial Covariance Matrix".

   e. Thomas et al. (US 6,141,393) discloses "Method And Device For Channel, Estimation, Equalization, And Interference Suppression".

   f. Kim et al. (US 6,690,712) discloses "Apparatus And Method For Transmission Diversity Using More Than Two Antennas".

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Willie J. Daniel, Jr. whose telephone number is (703) 305-8636. The examiner can normally be reached on 7:30-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marsha D. Banks-Harold can be reached on (703) 305-4379. The fax phone

number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

WJD,JR/wjd,jr
28 May 2004

CHARLES APPIAH
PRIMARY EXAMINER